09:36:12 OCA PAD INITIATION - PROJECT HEADER INFORMATION 09/16/87

Active

Project #: G-42-636 Cost share #: G-42-326 Rev #: 0
Center # : R6388-0A0 Center shr #: F6388-0A0 OCA file #:
Work type : RES
Contract#: 1 R01 AG07654-01 Mod #: INITIATION Document : GRANT
Prime #: Contract entity: GTRC

Subprojects ? : N
Main project #:

Project unit: PSYCH Unit code: 02.010.154
Project director(s):
FISK A D PSYCH

Sponsor/division names: DHHS/PHS/NIH / NATL INSTITUTES OF H
Sponsor/division codes: 108 / 001

Award period: 870901 to 880831 (performance) 881130 (reports)

Sponsor amount	New this change	Total to date
Contract value	92,848	92,848
Funded	92,848	92,848
Cost sharing amount		4,000

Does subcontracting plan apply ?: N

Title: AUTOMATIC/CONTROLLED PROCESSING AND AGING

PROJECT ADMINISTRATION DATA

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Security class (U,C,S,TS): U ONR resident rep. is ACO (Y/N): N
Defense priority rating: :N/A supplemental sheet
Equipment title vests with Sponsor GIT X
PRIOR INTERNAL APPROVAL REQUIRED IF NOT INCLUDED IN APPROVED NOA BUDGET

Administrative comments -
INITIATION

GEORGIA INSTITUTE OF TECHNOLOGY OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION/CLOSEOUT SHEET

Date 9/9/88

Project No. G-42-636/R6388-0A0 School/~~XXX~~ Psychology

Includes Subproject No.(s) N/A

Project Director(s) A. D. Fisk GTRC/~~XXX~~

Sponsor DHHS/PHS/NIH

Title Automatic/Controlled Processing and Aging

Effective Completion Date: 8/31/88 (Performance) 11/30/88 (Reports)

Grant/Contract Closeout Actions Remaining:

- [ ] None
- [X] Final Invoice or Copy of Last Invoice Serving as Final
- [ ] Release and Assignment
- [ ] Final Report of Inventions and/or Subcontract:
  Patent and Subcontract Questionnaire sent to Project Director [ ]
- [ ] Govt. Property Inventory & Related Certificate
- [ ] Classified Material Certificate
- [ ] Other

Continues Project No. Continued by Project No. G-42-614

COPIES TO:

Project Director
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Reports Coordinator (OCA)
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Other

1. Plans for Next Year

The major goals for next year are to conduct further empirical studies investigating the age-related characteristics of automatic processing, controlled processing, and automatic attention responses. Within the second year we also plan to refine a theoretical/formal model which provides explanatory and predictive utility for consolidating perceptual learning data.

One series of experiments will focus on age-related influences in the development of associative and priority learning phases of automatic process development. This experiment will assess young and older adults' ability to develop associative learning and priority learning. Subjects first will be trained in two VM conditions (Phase 1 of the experiment): (1) Categorical - a condition that allows unitization of the stimulus sets and (2) Mixed - a condition that inhibits unitization. Phase 1 should demonstrate associative learning characterized by unitization of the stimulus sets in the categorical condition and the resulting insensitivity to increases in comparison load. Phase 2 is designed essentially the same as Phase 1 except that mapping of the target and distractor words is consistent. One category from the categorical condition is chosen as a CM target set and the other serves as the CM distractor set. Similarly, for the previous mixed condition, four words become CM targets and four words become CM distractors. Phase 2 will evaluate learning above and beyond Phase 1 and will assess the extent of priority learning for young and older adults. Also, the importance of consistent mapping for automatic processing (AAR development) will be demonstrated. In phase 3 of the experiment, the CM target and distractor roles will be reversed. This phase will assess the strength of CM learning.

A second set of experiments will examine distractor inhibition and target learning. This experiment will test, as a function of age, the relative ability of CM targets to attract attention (gain "strength" or priority) and CM distractors to "repel" attention (develop low priority). This experiment is particularly geared toward understanding the relative importance of relevant (targets) and irrelevant (distractors) stimuli in governing performance. Subjects will be trained in two conditions where the targets and distractors are consistently mapped and one condition in

which the stimuli are variably mapped as targets and distractors. Subjects will then be transferred to conditions in which either the targets or the distractors remain the same (i.e., serve the same role as during training) or to conditions in which the targets or distractors are reversed (i.e, previous stimuli trained as targets become distractors or previously trained distractors become targets). It is predicted that, for young adults, the transfer conditions will result in minimal deficit in performance whereas the reversal conditions will show disrupted performance. For older adults, the pattern of performance relative to the young subjects will demonstrate the influence of target learning relative to distractor learning.

A third series of experiments will continue the investigation of the retention of previously developed automatic processes and the age-dependent ability to modify those automatic activations. This will be accomplished by examining the ability of young and older adults to inhibit color-word Stroop effects. Young and older adults will practice the color-word Stroop task for 30 days and the degree of interference attenuation will be measured. In previous experiments, young subjects have demonstrated the ability to overcome Stroop interference effects. The data from the experiments in series three will be important in that they will speak to the ability of older adults to change the priority of stimuli as a function of practice.

The fourth series will examine performance improvement as a function of amount of practice and the degree of stimulus consistency. This experimental series necessitates the tuning of the "multiple-frame" paradigm (dependent measure is accuracy not reaction time) for use with older adults. The initial programming and age-dependent frame speed characteristics have already begun. These experiments are important for two primary reasons. First, they will provide a more fine-grained analysis of the age-related characteristics of associative learning (initial learning in automatic process development). Second, a new perceptual learning paradigm will be developed that will provide data that is independent of motoric response time as well as allow the direct examination of reaction time and accuracy data across perceptual learning paradigms.

Finally, a third paradigm will be developed to examine the maintenance of processing control. Subjects will participate in experiments which utilize the multiple frame procedure and will be given CM and VM training until they reach asymptotic performance. To test the subjects' ability to control the processing of previously trained CM stimuli, multiple targets will occasionally be presented during a trial and subjects will be required to respond by indicating both when a target occurs and the number of targets occurring during the trial. When two targets do occur they will be varied in their spacing, from occurring on the same frame to four frames apart. The spacing of the target

stimuli will be varied to examine the time course of the "attention capture" of the previous CM trained stimuli. This series will allow the evaluation of the characteristics of attention training by assessing not only the degree of control subjects have over CM trained stimuli but also the time course of that control.

2. Description of Research/Activities Completed

Five experiments have been completed and three are near completion (to be completed by August). The first series examined age-related effects of extended "massed" consistent (CM) and varied (VM) mapping practice as well as the order of that practice (CM first vs. VM first) on perceptual learning. In the first experiment it was found that order of practice did not differentially affect VM performance for either age group nor did it affect young adults' CM performance. However, old subjects who received VM training before CM training had increased CM comparison slopes relative to the old subjects' first trained in CM. These differences persisted for 1800 trials. Regardless of practice order, young and old subjects' CM comparisons slopes were significantly different after the extended practice.

A second experiment is examining whether this phenomenon is "strategic" in nature or truly related to the target vs. distractor "strength" (a stimulus based effect). The experiment is essentially the same as the first experiment; however, true CM targets and CM distractors are being used in addition to the VM stimuli. In the first experiment, the distractors for CM training also served as VM stimuli; in this second experiment the CM and VM stimuli are nonoverlapping. If the "order effect" is present then that effect will be shown <u>not</u> to be stimulus-specific. If, however, the practice order effect does not appear, then evidence exists that the VM training in the first experiment allowed those stimuli to develop differential strength (over novel stimuli) and that ability of the "system" to change the strength of distractors (or target stimuli) is slower in older adults relative to young adults.

II. Unconfounding Memory Scanning and Visual Search

This series investigates the relative influence of memory search and visual search on mental comparison times. The experiment unconfounds memory and visual search processes. In the first experiment, letters were used as stimuli and performance after intermediate levels of practice was examined (2,592 CM and 2,592 VM trials). Memory set size and display size both varied from 1 to 3 (all combinations being tested) allowing the separate investigation of the effects of increase in memory load versus increase in display load. Experiment 2 examined potential interactions between age and memory/visual search

using more complex stimuli (semantic category search) over 10,368 trials (5,184 CM followed by 5,184 VM).

For both experiments, young and old subjects' mean VM RTs are a monotonically increasing function of the product of memory and display load suggesting that subjects compare each memory-set item against each display item. Overall RT dependence on total number of comparisons is fit well by linear functions but there are important age-dependent deviations. For young adults, when several points represent the same product of memory and display load (i.e., comparison load), RTs are slower when memory load is larger than display load. Older adults show an opposite deviation, RTs are slower when display load is larger than memory load. The data indicate additional "switching" time required for each additional memory-set item and that older adults are slowed as increasing filtering of the display items is required and suggest that young and old subjects' controlled processing performance can be influenced by different task related factors. Age-related CM effects were equivalent to our previous findings.

III. Type of Responding and Accumulation of Evidence

Interactions of stimulus consistency and response-set were examined. Each subject performed extended CM and VM search. Subjects either responded only when a target was present or only when a target was <u>not</u> present. After training, subjects transferred to the opposite response condition. During training, as in our previous experiments, age-related differences due to increases in memory-set size occurred only with CM practice. However, response reversal after training led to age-related effects for <u>both</u> CM and VM search. The transfer data suggest age-dependent strategic differences in processing and imply that older subjects may be more rigid in their use of VM search strategies (slower to adapt to new situations) or that they are affected somewhat differently than younger adults by situation-specific context.

IV. Activation of Well-learned Automatic Processes

This series examines retention of well-learned automatic processes. Subjects performed an arithmetic "Stroop" tasks. There were three types of equations: 1) Correct equations (e.g., 3 + 4 = 7, 4 X 2 = 8). 2) Associative equations; false equations that become true by substituting one operation sign with another. (e.g., 3 + 4 = 12 is correct for the multiplication operation). Associative equations produce substantial slowing in verification time and are referred to as Stroop interference equations. 3) Nonassociative equations; equations that are incorrect and do not become correct by operation substitution (e.g., 3 + 4 = 9). Older subjects were slower in overall verification times when compared to the younger adults. However, the pattern of performance is very similar across the age groups. Both young and older adults exhibit

strong Stroop interference effects for the associative trials suggesting that older adults' previously well-learned "automatic" processes do not diminish with age.

V. Focused Attention in Counting Tasks

In these experiments, young and older subjects participated in tasks requiring them to focus attention and count display elements. The display construction either encouraged grouping of digits or made such chunking difficult. In the first experiment, young and old subjects did not differ in their performance on this counting task except that older adults were slower in overall counting time. For both young and old subjects, grouping and spacing conditions produced facilitated counting speed. The second experiment is specifically examining old and young subjects' ability to chunk the displayed stimuli while counting and the impact of counting when chunking is inhibited.

3. Human Subjects

No substantial changes will be made from the general human subjects protocols described in the previous proposal.

4. PUBLICATIONS

Fisk, A. D, McGee, N. D., and Giambra, L. M. (in press). The influence of age on consistent and varied semantic category search performance. Psychology and Aging. (Preparation of manuscript supported, in part, by this grant)

Fisk, A. D., Rogers, W. A., and Giambra, L. M. (submitted). Perceptual Learning in Consistent and Varied Search: Age and Response Set Effects. Psychology and Aging.

Fisk, A. D., and Rogers, W. A. (in press). A hybrid connectionist/production system interpretation of age differences in perceptual learning. To appear in the Proceedings of the Tenth Annual Conference of the Cognitive Science Society. Hillsdale, NJ: Lawrence Erlbaum Associates.

Rogers, W. A., and Fisk, A. D. (in press). Age-Related Effects of Stimulus-Specific Context on Perceptual Learning. To appear in the Proceedings of the Human Factors Society 32nd Annual Meeting. Santa Monica, CA: Human Factors Society.

PRESENTATIONS

Rogers, W. A., and Fisk, A. D. (1988, April). Age-related influences of massed practice, practice type, and practice order on perceptual learning. Presented at the Cognitive Aging Conference, Atlanta.

Fisk, A. D., and Rogers, W. A. (TBP, 1988). A connectionist interpretation of age differences in memory/visual search. To be presented (August, 1988) at the Cognitive Science Annual Meeting, Montreal.

Fisk, A. D., and Rogers, W. A. (TBP, 1988). Age-dependent influences of memory and visual load in perceptual learning. To be presented at the Annual Meeting of the American Psychological Association, Atlanta.

Rogers, W. A., and Fisk, A. D. (TBP, 1988). Age-Related Effects of Stimulus-Specific Context on Perceptual Learning. To be presented (October, 1988) at the Human Factors Society 32nd Annual Meeting, Santa Monica.